Assessing the Security of Federal Information Technology Systems

The Development of Standardized Certification and Accreditation Guidelines and Provider Organizations

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Today's Climate

- Highly interactive environment of powerful computing devices and interconnected systems of systems across global networks
- Federal agencies routinely interact with industry, private citizens, state and local governments, and the governments of other nations
- The complexity of today's systems and networks presents great security challenges for both producers and consumers of information technology

Today's Challenge

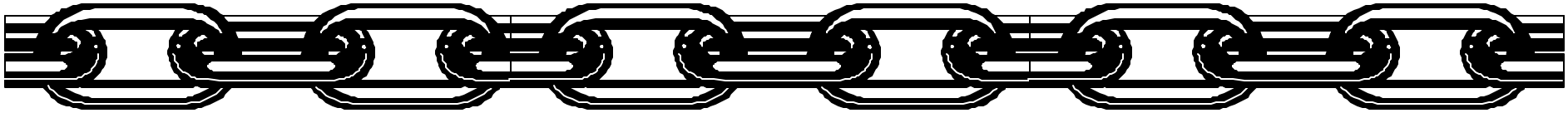
- Need for greater confidence in the security of enterprise IT systems
- Need for consistency in the approaches used to assess the capabilities and limitations of IT systems in Federal agencies
- Need for competent personnel with requisite skill sets to conduct IT system assessments

Security Assurance in IT Systems

Building more secure systems requires --

- Well defined system-level security requirements and security specifications
- Well designed component products
- Sound systems security engineering practices
- Competent systems security engineers
- Appropriate metrics for product/system testing, evaluation, and assessment
- Comprehensive system security planning and life cycle management

The Security Chain



Links in the Chain
(Non-technology based examples)

- ✓ Physical security
- ✓ Personnel security
- ✓ Procedural security
- ✓ Risk management
- ✓ Security policies
- ✓ Security planning
- ✓ Contingency planning

Links in the Chain
(Technology based examples)

- ✓ Access control mechanisms
- ✓ Identification and authentication devices
- ✓ Audit mechanisms
- ✓ Encryption mechanisms
- ✓ Firewalls
- ✓ Smart cards
- ✓ Biometrics

Adversaries attack the weakest link…where is yours?

National Policy

Office of Management and Budget Circular A-130, *Management of Federal Information Resources* requires federal agencies to:

- Plan for security
- Ensure that appropriate officials are assigned security responsibility
- Authorize system processing prior to operations and periodically, thereafter.

Achieving Adequate Security

- OMB Circular A-130 defines *adequate security* as security commensurate with the risk and magnitude of harm resulting from the loss, misuse, or unauthorized access to or modification of information
- Adequate security emphasizes the risk-based policy for cost-effective security established by Public Law 100-235, the Computer Security Act of 1987

System Accreditation

"A management decision by a senior agency official to authorize operation of an IT system based on the results of a certification process and other relevant considerations…"

- Assigns responsibility for the safe and secure operation of an IT system to a designated authority
- Balances mission requirements and the residual risks to an IT system after the employment of appropriate protection measures (security controls)

Security Certification

"*A comprehensive analysis of the technical and non-technical aspects of an IT system in its operational environment to determine compliance to stated security requirements and controls…*"

- Employs a set of structured verification techniques and verification procedures during the system life cycle
- Demonstrates the security controls for an IT system are implemented correctly and are effective
- Identifies risks to confidentiality, integrity, and availability of information and resources

Program Objectives

Phase I

- To develop standardized guidelines for conducting security certifications and accreditations of federal IT systems

Phase II

- To create a national network of accredited organizations capable of providing cost effective, quality security assessment services based on the standardized guidelines

PHASE I

Development of Guidance

- NIST Special Publication 800-37

  Guidelines for the Security Certification and Accreditation of Federal Information Technology Systems

- NIST Special Publication 800-53

  Minimum Security Controls for Federal Information Technology Systems

- NIST Special Publication 800-53A

  Techniques and Procedures for the Verification of Security Controls in Federal Information Technology Systems

PHASE II

Development of Capability

- Create criteria for accrediting public and private sector organizations to conduct security certifications in accordance with NIST Special Publications 800-37, 800-53, 800-53A
- Develop associated proficiency tests to demonstrate assessment organization competence
- Accredit public and private sector enterprises to conduct security certifications by Fall 2004

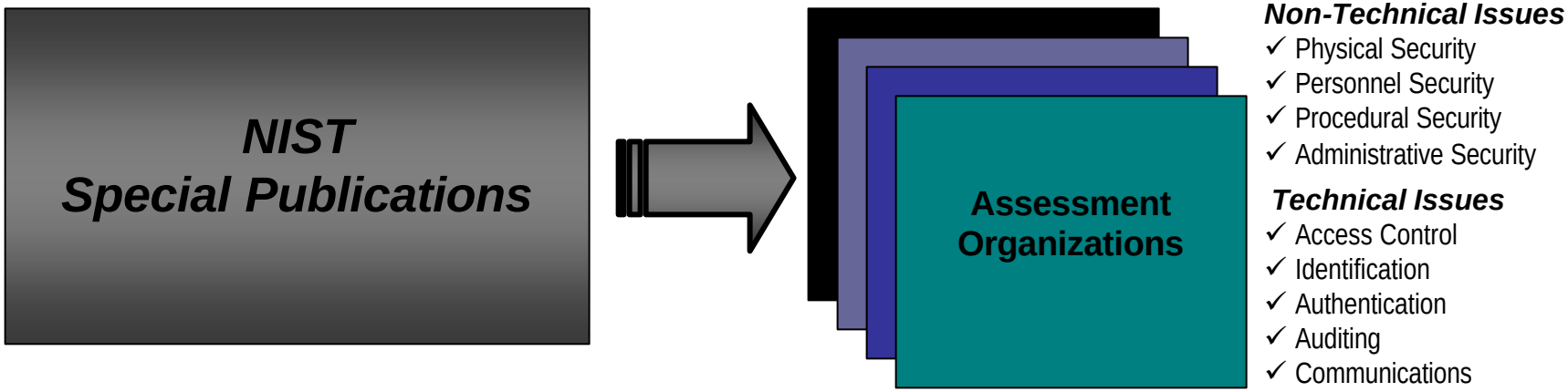
Development Strategy

- Limited federal government involvement
  - **Develop and maintain standardized system certification and accreditation guidelines (Special Publication 800-37)**
  - **Develop and maintain standardized (minimum) security controls and verification techniques/procedures (Special Publications 800-53 and 800-53A)**
  - **Develop and maintain assessment organization program (i.e., accreditation criteria and assessment methods for participating organizations)**
  - **Accredit public and private sector assessment organizations to for competence**
- Maximum use of private sector capabilities
  - **Collaborate with industry on security C&A guideline development**
  - **Encourage private sector development of C&A tools and training classes**
  - **Use private sector assessment organizations to conduct security certifications for federal customers (when desired)**

Comprehensive Security Program

Standardized Guidelines for Certification and Accreditation

Network of Accredited Assessment Organizations

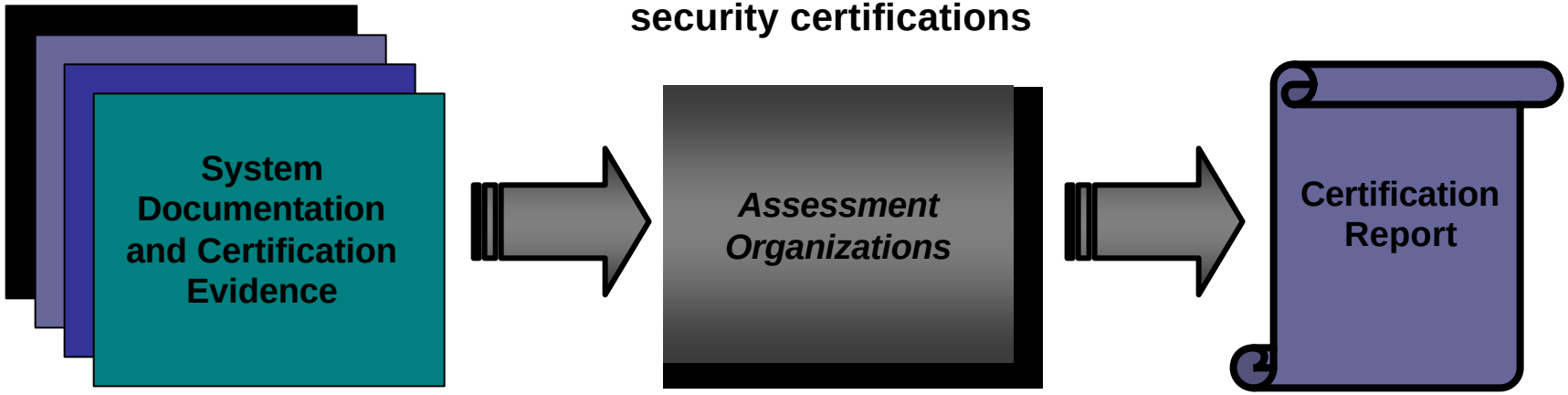


A flexible, tailorable, and robust security certification process for federal agencies

Competent providers of security assessment services

Assessing System Security

Public and private sector, accredited assessment organizations conduct security certifications



Program managers or system owners provide system documentation to independent, impartial certification agents

Certification results submitted to agency officials for final decisions on authorizations to operate the systems

Significant Features

- Employs a standardized process for the certification and accreditation of IT systems
- Integrates the use of standardized security controls and standardized verification techniques/procedures
- Minimizes documentation required and produced during the C&A process
- Maximizes the cost-effective production of essential evidence to support informed, risk-based accreditation decisions by senior agency officials

Significant Benefits

- More consistent, comparable, and repeatable system-level evaluations or system certifications of federal IT systems
- More complete, reliable technical information for IT system accreditation authorities—leading to better understanding of complex systems and associated risks and vulnerabilities
- Greater availability of competent certification services for public and private sector customers

Special Publication 800-37

Guidelines for the Security Certification and Accreditation of Federal Information Technology Systems

- Establishes a standard process, general tasks and specific subtasks to certify and accredit IT systems supporting the executive branch of the federal government
- Focuses on federal systems processing, storing and transmitting sensitive (unclassified) information but can be applied to national security or intelligence systems, if so directed by appropriate authorities
- Supercedes NIST Federal Information Processing Standards (FIPS) Publication 102

Note: Projected publication Fall 2002.

Special Publication 800-53

Minimum Security Controls for Federal Information Technology Systems

- Provides standardized security controls for confidentiality, integrity, and availability
- Arrays controls in a standard package of basic controls (low levels of concern for C, I, A)
- Offers optional controls for moderate and high levels of concern in agency-defined supplemental package
- Integrates security controls from many sources—policies, directives, and guidelines (e.g., NIST SP 800-26, DoD 8500, D/CID 6-3, ISO/IEC 17799, and GAO FISCAM)

Note: Projected publication Spring 2003.

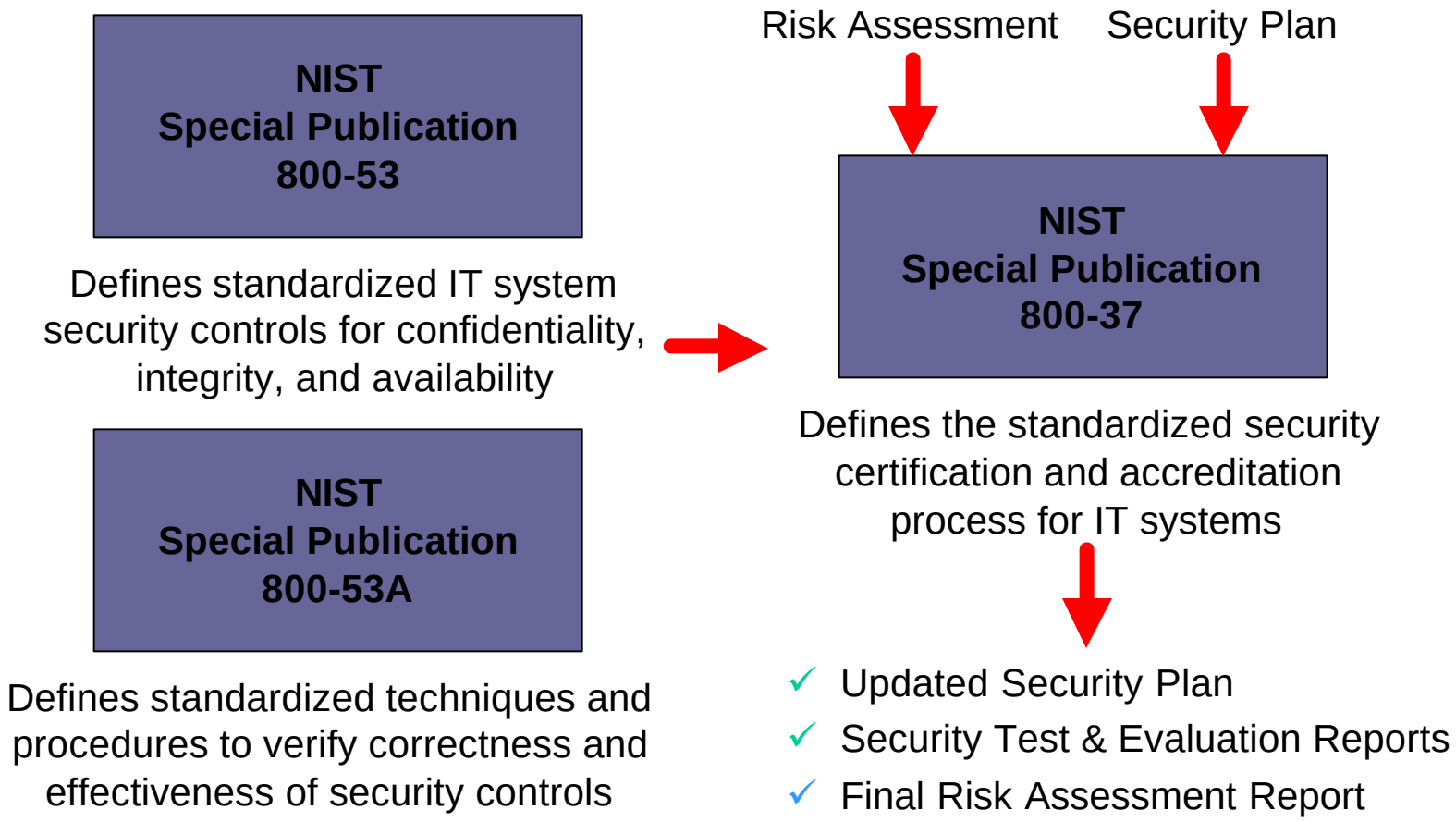
Special Publication 800-53A

Techniques and Procedures for the Verification of Security Controls in Federal Information Technology Systems

- Provides standardized verification techniques and detailed verification procedures for security controls in SP 800-53
- Associates verification techniques with the Security Certification Levels in SP 800-37 and addresses the level of rigor applied to the security test and evaluation activities
- Specifies certifier actions necessary to demonstrate correct and effective implementation of security controls in SP 800-53

Note: Projected publication Spring 2003.

Security Accreditation Model



Phases of the C&A Process

- Pre-certification Phase
- Certification Phase
- Accreditation Phase
- Post-accreditation Phase

Key Security Factors

- Confidentiality
  - Assurance that information in an IT system is not disclosed to unauthorized persons, processes or devices
- Integrity
  - Assurance that information in an IT system is protected from unauthorized, unanticipated, or unintentional modification or destruction
- Availability
  - Assurance that information, services, and IT system resources are accessible to authorized users and/or system-related processes on a timely and reliable basis and are protected from denial of service

Characterizing an IT System

- Examine the *criticality/sensitivity* of the system and the information the system processes, stores, and transmits
- Assess the *exposure* of the system and its information to both internal and external threats
- Assign appropriate *levels of concern* for both system criticality/sensitivity and exposure

System Critical/Sensitivity

- The importance and nature of the information processed, stored, and transmitted by the IT system to the organization’s mission and day-to-day operations
- Measured by analyzing the system requirements for confidentiality, integrity, and availability

System Exposure

A measure of the potential risk to an IT system from both external and internal threats:

- *External system exposure factors:*
  - Method by which users access the system, (e.g., dedicated connection, intranet connection, Internet connection, wireless network, PTS connection)
  - Existence of backend connections to the system and to what the backend systems are connected
  - Number of users that access the system
- *Internal system exposure factors:*
  - Security background assurances and/or clearance levels, access approvals, and need-to-know for individuals using the system

Levels of Concern

(Low, Moderate, High)

- Level of concern for *confidentiality*
  - Based on the tolerance for unauthorized disclosure or compromise of information on the system
- Level of concern for *integrity*
  - Based on the tolerance for unauthorized modification or destruction of information on the system
- Level of concern for *availability*
  - Based on the tolerance for delay in the processing, transmission, or storage of information on the system or the tolerance for the disruption or denial of a service provided by the system

Levels of Concern

(Low, Moderate, High)

- Level of concern for external exposure
  - Based on the definitions in SP 800-37 (user access methods, backend connections, number of users)
- Level of concern for internal exposure
  - Based on the definitions in SP 800-37 (security background assurances/clearances, access approvals, need-to-know)
- Level of concern for total system exposure
  - Based on the values assigned to both external and internal exposure factors as defined in SP 800-37

System Characterization

Levels of concern for confidentiality, integrity, availability and system exposure determine:

- Security controls for the IT system
- Security certification level

Security Certification Level 1

- Independent assessment of an IT system requiring minimal expenditure of resources
- Appropriate for systems engendering:
  - Low levels of concern for confidentiality, integrity, and availability, or
  - Moderate to high levels of concern for confidentiality, integrity, and/or availability *and* systems operating in low to moderate risk environments
- Demonstrates at relatively low levels of assurance that the security controls for an IT system are correctly implemented and are effective in their application
- Employs simple, checklist-based, verification techniques such as personnel interviews, documentation reviews, and observations

Security Certification Level 2

- Independent assessment of an IT system requiring limited to moderate expenditure of resources
- Appropriate for systems engendering:
  - Moderate levels of concern for confidentiality, integrity, and/or availability, or
  - High levels of concern for confidentiality, integrity, and/or availability *and* systems operating in low to moderate risk environments
- Demonstrates at moderate levels of assurance that the security controls for an IT system are correctly implemented and are effective in their application
- Employs standard, commercially available, assessment tools and verification techniques

Security Certification Level 3

- Independent assessment of an IT system requiring substantial expenditure of resources
- Appropriate for systems engendering high levels of concern for confidentiality, integrity, and availability
- Demonstrates at high levels of assurance, that the security controls for IT systems are correctly implemented and are effective in their application
- Employs the most advanced assessment tools and verification techniques available

Security Controls

- Management Controls
  - Controls that address the security management aspects of the IT system and the management of risk for the system
- Operational Controls
  - Controls that address the security mechanisms primarily implemented and executed by people (as opposed to systems)
- Technical Controls
  - Controls that address security mechanisms contained in and executed by the computer system

Customer-Driven Selection

- Baseline of security controls for all IT systems from standard package
- Additional security controls in supplemental package based on increased levels of concern for confidentiality, integrity, and/or availability
- Waivers and/or substitutions of security controls based on system exposure and risk-based decisions

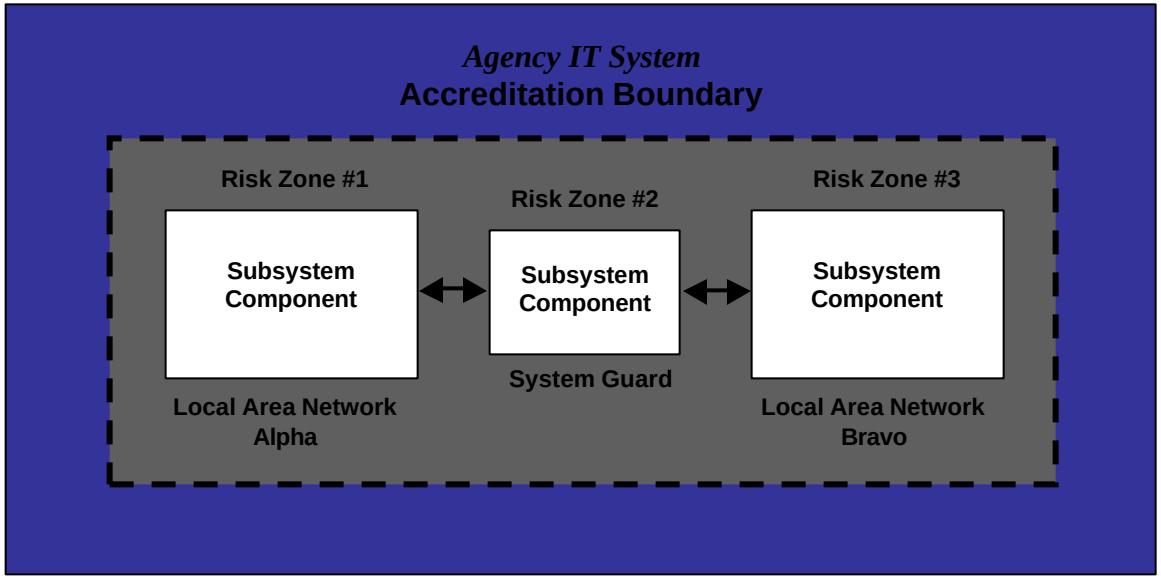
Large and Complex Systems

- Establish the accreditation boundary for the IT system
- Define a set of system-level components, or subsystems, for both major applications and general support systems
- Subsystem decomposition facilitates the application of the C&A process in a more cost effective manner and supports the concepts of risk management and defense-in-depth
- Each subsystem component is fully characterized in the security plan and an appropriate set of security requirements and security controls identified for that component

Large and Complex Systems

- Each subsystem component may be certified at a different certification level, depending on the levels of concern expressed by the agency
- The critical, high value subsystem components demand and receive more attention during the certification process than the less important, low-value subsystem components
- The final system accreditation may contain one or more subsystem components certified to the appropriate level based on the documented levels of concern and associated security controls

Large and Complex Systems



- Security plan reflects the decomposition of the IT system into subsystems
- Each subsystem component is certified at the appropriate certification level
- Risk assessment applied to entire IT system
- Total risk to the system may be greater than the sum of the risks to the individual subsystem components

Certification Package

Key Documents---

- Security Plan
- Security Test & Evaluation Reports
- Final Risk Assessment Report
- Certifier’s Statement

Security Plan

- Provides an overview of the security requirements for the IT system
- Describes the existing or planned security controls (management, operational, and technical) for meeting those requirements
- Delineates responsibilities and expected behavior of individuals who access the system

- The security plan is a living document that is updated throughout the system development life cycle as new information becomes available.
- Reference NIST Special Publication 800-18, *Guide for Developing Security Plans for Information Technology Systems*, December 1998.

ST&E Reports

- Documents the results of the ST&E activities (verification techniques and verification procedures used to demonstrate the security controls identified in the security plan are correctly implemented and effective)
- Developmental ST&E Report:
  - Applicable to new systems or systems undergoing major upgrades
  - Documents ST&E activities during the development and acquisition phase of the system development life cycle
- Operational ST&E Report:
  - Applicable to new, upgraded, or legacy systems
  - Documents ST&E activities during the implementation or operation/maintenance phases of the system development life cycle

Final Risk Assessment Report

- Documents threats to and vulnerabilities in the IT system
- Contains proposals for and evaluations of the effectiveness of various security controls
- Provides trade-offs associated with the security controls (e.g., performance impact and cost)
- States residual risk associated with a candidate set of security controls

- The risk assessment report is a living document that is updated throughout the system development life cycle as new information becomes available.
- Reference NIST Special Publication 800-30, *Risk Management Guide for Information Technology Systems*, January 2002.

Certifier’s Statement

- Provides an overview of the security status of the system and brings together, all of the information necessary for the DAA to make an informed, risk-based decision
- Documents that the security controls are correctly implemented and effective in their application
- Documents the security controls not fully implemented or implemented incorrectly and provides corrective actions

Accreditation Decisions

- Full Accreditation
- Interim Accreditation
- Accreditation Disapproval

Accreditation Package

- Conveys DAA's final accreditation decision
- Constructed from information provided in the certification package
- Normally consists of:
  - Accreditation letter
  - Security plan
  - Report documenting the basis for the accreditation decision

➢ Certain information from the security plan, ST&E reports, and risk assessment report may, at the discretion of the DAA, be withheld in the final accreditation package due to its sensitive nature.

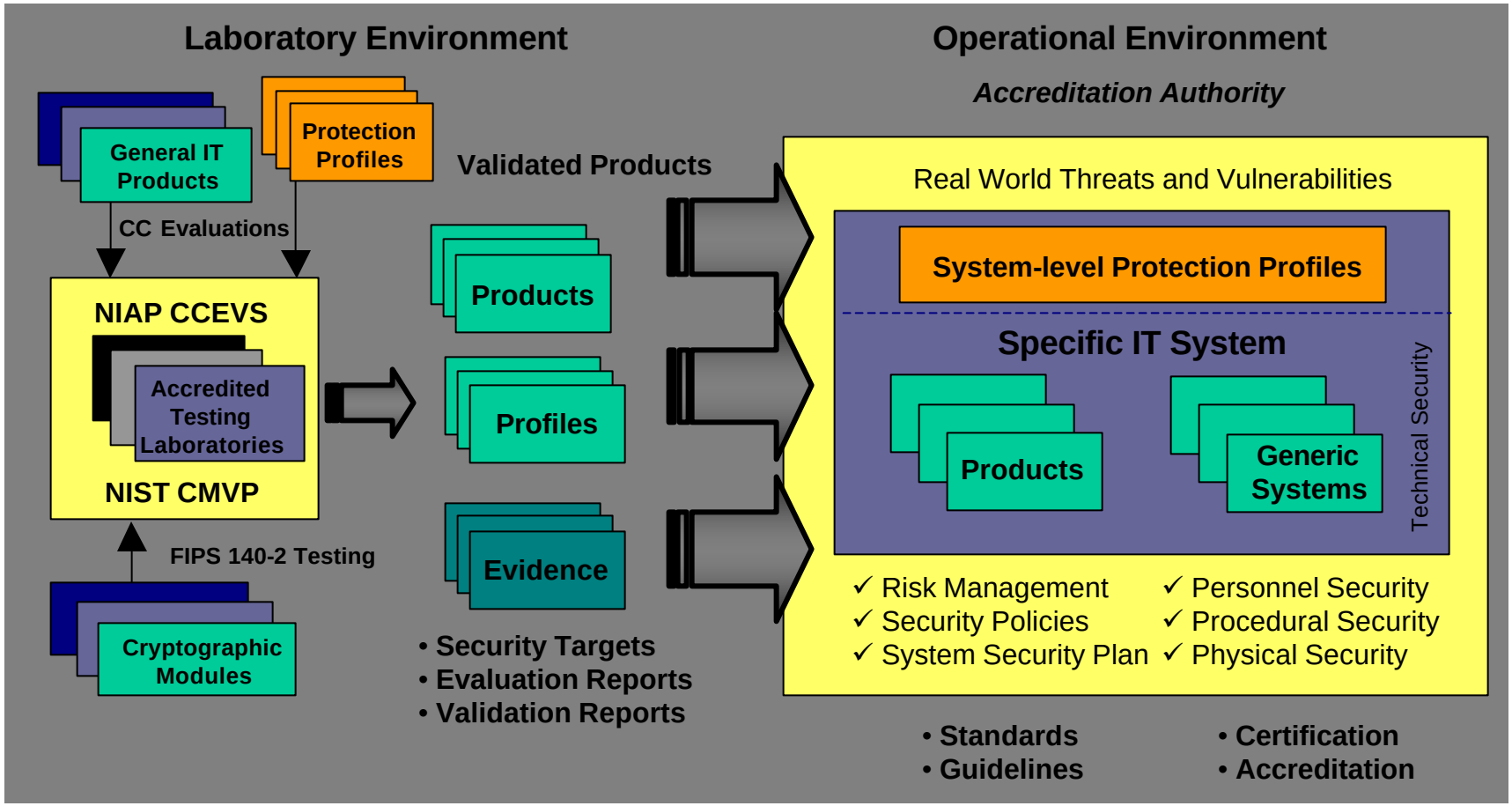
Product Testing Programs

Supporting the C&A Process

- NIST Cryptographic Module Validation Program
  - Testing commercial cryptographic modules against U.S. Government Standard (FIPS 140-2 *Security Requirements for Cryptographic Modules*)
  - Independent, private-sector, accredited testing laboratories with validation of test results by NIST and CSE (Canada)
- NIAP Common Criteria Evaluation and Validation Program
  - Testing commercial IT products against international standard (ISO/IEC 15408 *Common Criteria for IT Security Evaluation*)
  - Independent, private-sector, accredited testing laboratories with validation of test results by NIST and NSA

A Comprehensive Approach

Linking Critical Assessment Activities



Key Milestones

- NIST Special Publication 800-37 (draft) released for public review

  28 October 2002

  http://csrc.nist.gov/sec-cert

- Public Comment Period

  28 October 2002 through 31 January 2003

- Comments to NIST Computer Security Division

  sec-cert@nist.gov

Note: NIST Special Publications 800-53 and 800-53A projected for completion and public review in Spring 2003

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